

# Functional Outcome and Quality of Life After Nonoperative Treatment of Posterior Process Fractures of the Talus

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## Abstract

**Background:** Fractures of the posterior process of the talus are frequently overlooked, possibly leading to nonunion, arthritis, and chronic pain. Given the rare occurrence, previous case series have been small and without functional outcome scores. Therefore, we aimed to provide evidence on outcomes after nonoperative and operative management of posterior process fractures of the talus.

**Methods:** All patients treated at a level I trauma center between 2012 and 2018 were retrospectively evaluated. Patient, fracture, and treatment characteristics were collected, and functional outcome as well as quality of life were assessed. Twenty-nine patients with posterior process fractures of the talus were identified in our database.

**Results:** The most frequently seen mechanism of trauma was fall from height in 13 patients (44.8%). Twenty-two patients underwent primary arthrodesis or operative reduction and fixation of the fracture (75.9%). Eighty-two percent of the patients returned the questionnaires with a mean follow-up of 6 years. The 2 patients with primary arthrodesis were excluded from outcome analysis. The mean Foot Function Index score was 1.8 (range 0.0-10). The mean American Orthopaedic Foot & Ankle Society (AOFAS) score was 78.7 points (range 0-100). The mean quality of life EuroQol-5D (EQ-5D) index score was 0.78 (range -0.26 to 1). The mean visual analog scale (VAS) on overall patient satisfaction was 8.2 (range 1-10).

**Conclusion:** Operative management of extended posterior talar fractures was found to provide good functional outcome, quality of life, and patient satisfaction. Although the patients treated nonoperatively were found to have less severe injuries, they demonstrated worse overall outcome, which is supportive of surgical management. Nonoperative treatment is therefore only justified in selected patients.

**Level of Evidence:** Level IV, retrospective case series.

**Keywords:** posterior process fracture, Cedell fracture, ankle injuries, talus, trauma

## Introduction

In general, talar fractures are uncommon, constituting less than 1% of all fractures in the human body and between 3% and 6% of fractures of the foot.<sup>10</sup> Talar fractures and, in particular, the more severe talar fracture patterns are increasingly being seen because of improved survival from serious injuries.<sup>11</sup> In 1974, Cedell was the first to describe a series of posteromedial process fractures of the talus.<sup>2</sup>

Because the posterior process involves both the tibiotalar (posterior ankle) and talocalcaneal (posterior facet of the subtalar) joints, even minimal displacement of the fracture fragment may lead to significant long-term consequences, including joint misalignment and posttraumatic arthritis. Diagnosing fractures of the posterior process of the talus can be challenging, given its clinical and radiographic similarity to an ordinary ankle sprain.<sup>2,7,8</sup> Standard imaging workup includes ankle radiographs and an additional

computed tomographic (CT) scan in cases with a high index of suspicion, which is superior in the assessment of size, displacement, and comminution of talar process fractures.<sup>4,5,7</sup>

Because of its rare occurrence, previous case series have been small and without functional outcome scores. Therefore, this study aimed to gain insight in the management and outcomes of posterior process fractures of the talus treated in a level I trauma center.

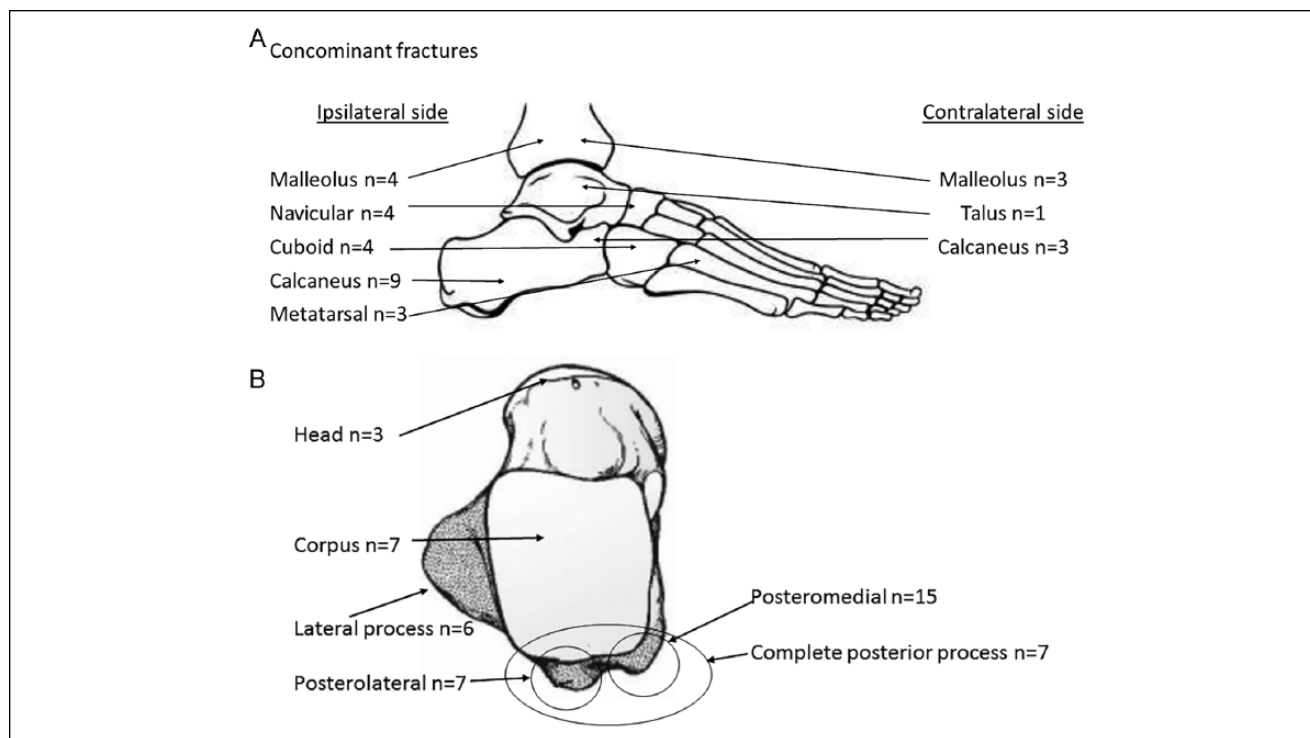
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**Figure 1.** (A) Concomitant fractures. (B) Ipsilateral concomitant talar fractures, superior view.

## Methods

### Design and Patients

We analyzed a retrospective cohort of all trauma patients with posterior process fractures of the talus who were treated at a level 1 trauma center between January 1, 2012, and December 31, 2018. Institutional review board approval and informed consent were obtained. Patients were included from the electronic hospital database using the billing code (DBC) 241 and surgical code 338733. All cases were reviewed and patients with involvement of the posterior process were included in this study. Patients younger than 18 years at the day of last follow-up were excluded.

### Variables

Patient-related clinical and radiographic data were extracted from the electronic hospital database and PACS (picture archiving and communication system). Variables included age at injury, gender, American Society of Anesthesiologists (ASA) classification, mechanism of trauma and concomitant ipsi- or contralateral lower extremity injuries. Imaging was reviewed by a radiologist and a trauma surgeon in order to categorize the fracture based on anatomical side, intra- or extra-articular location, joint dislocation, and complexity. With respect to management, data were collected on the type of treatment, follow-up, complications, and the possible need for implant removal. Functional outcome was assessed using the Foot Function Index (FFI, best score 0

points) and the American Orthopaedic Foot & Ankle Society hindfoot score (AOFAS, best score 100 points). The AOFAS score was divided into groups according to the literature: a score of 90 to 100 was graded as an excellent result; 75 to 89 as good; 50 to 74 as fair, and less than 49 points was graded as a failure or poor outcome. Quality of life (QOL) was measured by the EuroQol-5D (EQ-5D). This included assessment of perceived general health on a visual analog scale (VAS) of 0 to 100, in which 100 represented excellent general health (EQ-VAS). Patient satisfaction was also measured using the VAS of zero to 10, in which 10 represents the best possible satisfaction.

### Demographics

Twenty-nine patients with posterior talar process fractures were identified. There were slightly more men ( $n = 16$ , 55%) with an overall average age at the day of trauma of 42 years (range 14-79). Thirteen patients were referred from other hospitals (44.8%). The most frequently seen mechanism of trauma was fall from height in 13 patients (44.8%). Patient and trauma characteristics are described in Supplementary Table S1. In 15 patients, the medial posterior process was fractured (51.7%), in 7 patients, the lateral posterior process (24.1%) and in 7 patients the complete posterior process (24.1%). In 6 patients the posterior process of the talus was fractured without any other concomitant ipsilateral lower extremity fractures. Fracture characteristics are described in Figure 1. One patient died during follow-up



**Figure 2.** (A) Preoperative computed tomographic (CT) scanning in combination with postoperative results. (i, ii) CT scan with axial and sagittal view showing a fracture of the complete posterior process. (iii, iv) Radiographs, coronal and sagittal view, showing postoperative results with 4 screws. (B) Preoperative computed tomographic (CT) scanning in combination with postoperative results. (i, ii) CT scan with coronal and sagittal view showing a fracture of the posteromedial process. (iii, iv) Radiographs, sagittal and coronal view, showing postoperative results with plate and screws.

because of a colorectal carcinoma. The questionnaires were sent to the remaining 28 patients, of whom 23 responded (82%), leading to a loss to follow-up of 18% ( $n = 5$ ), of which 2 patients were mentally disabled, 1 patient had severe neurologic damage during the trauma and was not able to fill in the questionnaires, and 2 patients did not reply. The mean follow-up time from the day of trauma was 6.0 years (range 1.3-17.7 years). All patients were evaluated at the outpatient clinic. Because primary arthrodesis and open reduction and internal fixation (ORIF) cannot be rightfully

compared by means of functional outcome, we excluded the 2 patients with primary arthrodesis in the outcome analyses.

### Statistical Analysis

The statistical analysis was performed using the Statistical Package for the Social Sciences, version 24 (IBM Corp, Armonk, NY). Numeric data are expressed with means, and categorical data are shown as numbers with percentages.

### Results

Twenty-two patients underwent operative reduction and fixation of the fracture (75.9%). In 2 of these patients, this was combined with primary arthrodesis (6.9%). Two examples of preoperative CT images in combination with the postoperative results are shown in Figure 2. The mean duration between the day of trauma and the definitive surgery was 15 days (range 2-60 days). Seven patients underwent another operation before the definitive operation (24.1%). This consisted of an external fixator in 4 patients (13.8%) and closed reduction in 2 patients (6.9%), and 1 patient underwent several operations with wound irrigation and debridement because of a wound infection after an open fracture (3.4%). In 7 of 22 operated patients, the implants were removed (31.8%).

Four out of five nonoperatively treated patients who completed the survey returned to their normal daily activities (80%). Two of the nonoperative managed patients developed arthritis of the posterior talocalcaneal joint for which arthrodesis was performed. Two-thirds of patients treated operatively returned to their normal daily activities ( $n = 11$  out of 16 patients who returned the survey, 68.8%). One-third of the operatively managed patients underwent implant removal ( $n = 7$ , 31.8%). For all included patients, the mean FFI score was 1.8 (range 0.0-10). According to the AOFAS score, 4 patients had an excellent outcome, 11 had a good outcome, 5 had a fair outcome, and in 1 patient the outcome was poor with a mean total score of 78.7 points (range 0-100). The mean quality of life EQ-5D index score was 0.78 (range -0.26 to 1). The mean VAS on overall patient satisfaction was 8.2 (range 1-10). Treatment characteristics, functional outcome, and quality of life scores are described in Table 1.

### Discussion

Posterior process fractures of the talus occur rarely isolated but are rather part of a larger injury. In general, patients with more extensive fractures of the posterior process with dislocation and/or intra-articular gaps or step-offs ( $>3$  mm) were managed by ORIF. Operative management of extensive posterior talar fractures was found to provide good

**Table 1.** Treatment Characteristics, Functional Outcome, and Quality of Life Scores.<sup>a</sup>

Treatment	Total Group (N = 29)	Operative (n = 22, 75.9%)	Nonoperative (n = 7, 24.1%)
ORIF, n		20	–
Primary arthrodesis, n		2	–
Available outcome measurements, n	21	16	5
Functional outcome			
FFI, mean (range)	1.8 (0 to 10)	1.51 (0 to 6.83)	2.59 (0 to 10)
AOFAS, mean (range)	78.7 (0 to 100)	81.6 (51 to 100)	69.6 (0 to 100)
Excellent outcome, n	4	3	1
Good outcome, n	11	8	3
Fair outcome, n	5	5	0
Poor outcome, n	1	0	1
Quality of life			
EQ-5D index	0.78 (–0.26 to 1)	0.82 (0.25 to 1.00)	0.63 (–0.26 to 1)
Patient satisfaction	8.2 (1 to 10)	8.63 (5 to 10)	6.8 (1 to 10)

Abbreviations: AOFAS, American Orthopaedic Foot & Ankle Society Score; EQ-5D, EuroQol-5D; FFI, Foot Function Index; ORIF, open reduction internal fixation.

<sup>a</sup>Data are presented as mean with range.

functional outcome, quality of life, and patient satisfaction. Although the fractures treated non-operatively were found to have less severe injuries, they demonstrated worse overall outcome, which is thus supportive of surgical management. In our case series, the majority of patients sustained a talar fracture due to high energy trauma (n = 19, 65.5%). Only 2 of these 19 patients had an isolated posterior process fracture, indicating that this type of fracture was mostly associated with other fractures or injuries such as ipsi- and/or contralateral fractures of the lower extremities. This was thought to be due to the fact that our hospital is a level 1 trauma center, compared to level 2 and 3 centers in the literature, where a higher percentage of isolated talar fractures was described. Standard trauma radiographs of the ankle were made in all patients. In addition to the routine trauma radiographs, a CT scan was made in all our patients for the assessment of size, displacement, comminution, articular involvement, and for preoperative planning.<sup>4,5</sup> In our case series, all patients with fractures of the posterior process with dislocation and/or intra-articular gaps or step-offs (>3 mm) were treated operatively (n = 22, 75.9%). The nonoperatively managed group consisted of patients with isolated avulsion fractures or fractures without or with minimal dislocation (n = 7, 24.1%). Severely comminuted fractures (n = 2) with joint dislocation were treated with external fixation followed by early subtalar arthrodesis 20 and 60 days after trauma, respectively, which is consistent with previous literature.<sup>1,3,4,6,9</sup>

Comparing functional outcome, quality of life, and patient satisfaction between operative and nonoperative groups, operative management was found to be superior (Table 1). Considering that the fractures in the operative group were more severe and dislocated emphasizes the importance of a predominant surgical approach in this type

of fracture. Avascular necrosis of either the posterior process or talar body, narrowing of the subtalar joint space, and arthritis have been reported in literature. The latter was not observed in our series.

## Limitations

Despite the retrospective design, this is a large consecutive case series. Moreover, it used validated outcome scores to systematically evaluate functional outcome of this relatively rare type of fracture. In only 6 patients the posterior process of the talus was fractured without any other concomitant ipsilateral lower extremity fractures, probably because of the study being conducted at a level 1 trauma center. It was not possible to determine the effect size of the talus fracture to the functional outcome and quality of life due to the presence of concomitant ipsilateral lower extremity fracture.

## Conclusion

Operative management of extensive posterior talar fractures was found to provide good functional outcome, quality of life, and patient satisfaction. Although the fractures treated nonoperatively were found to have less severe injuries, they demonstrated worse overall outcome, which is supportive of surgical management. Nonoperative treatment is therefore only justified in selected patients.


## Declaration of Conflicting Interests

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## Supplemental Material

Supplemental material for this article is available online.

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